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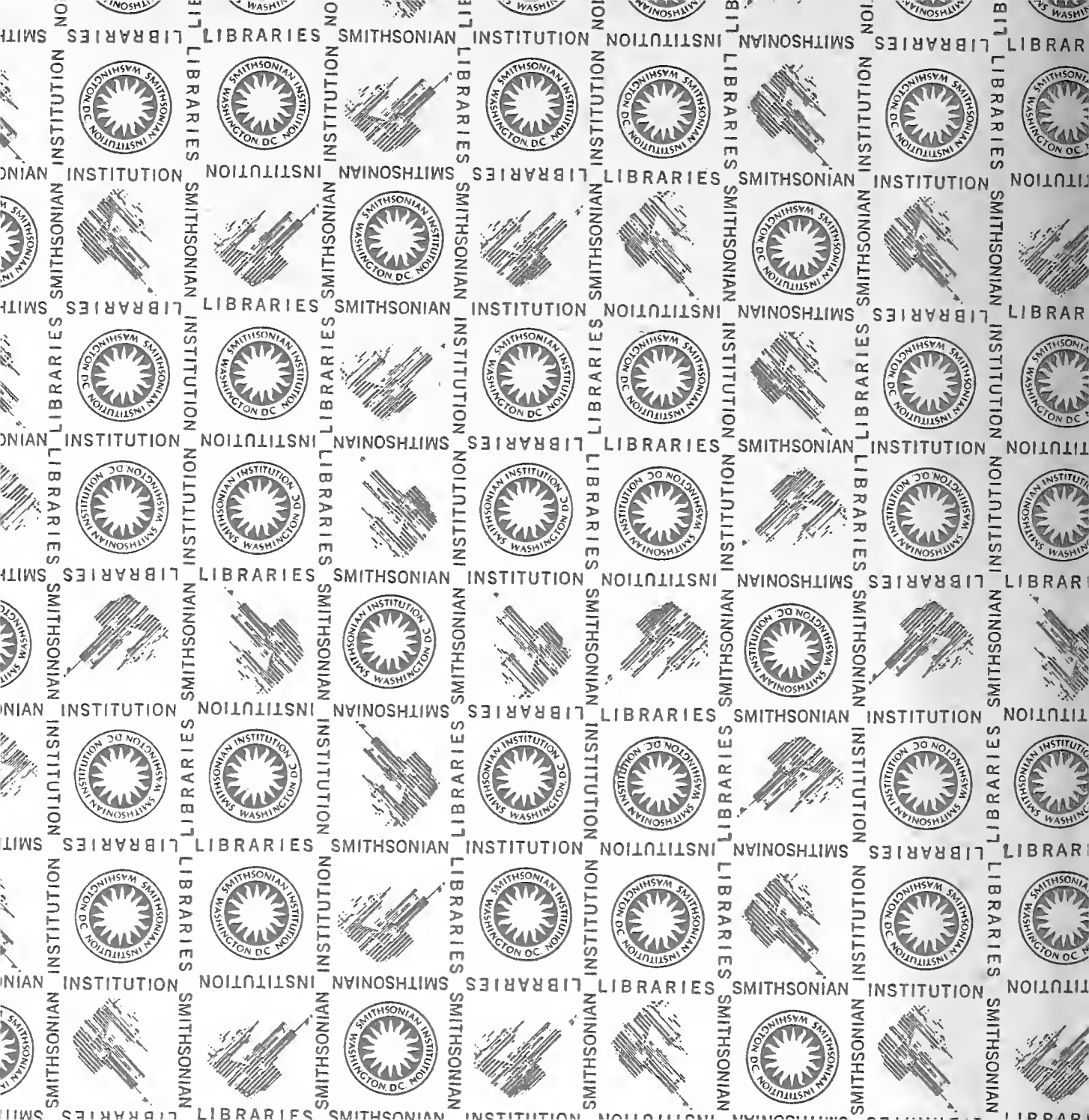
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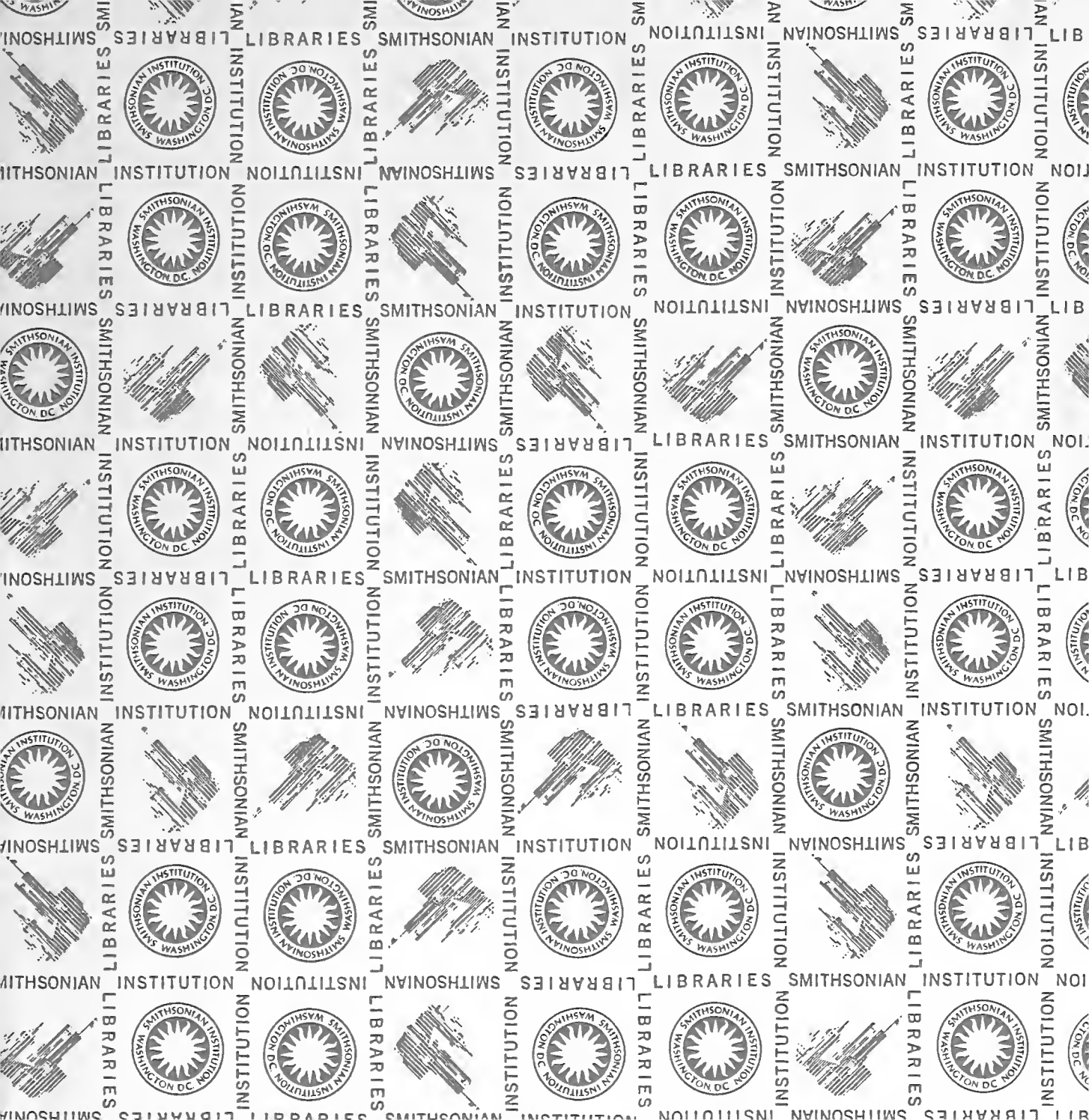
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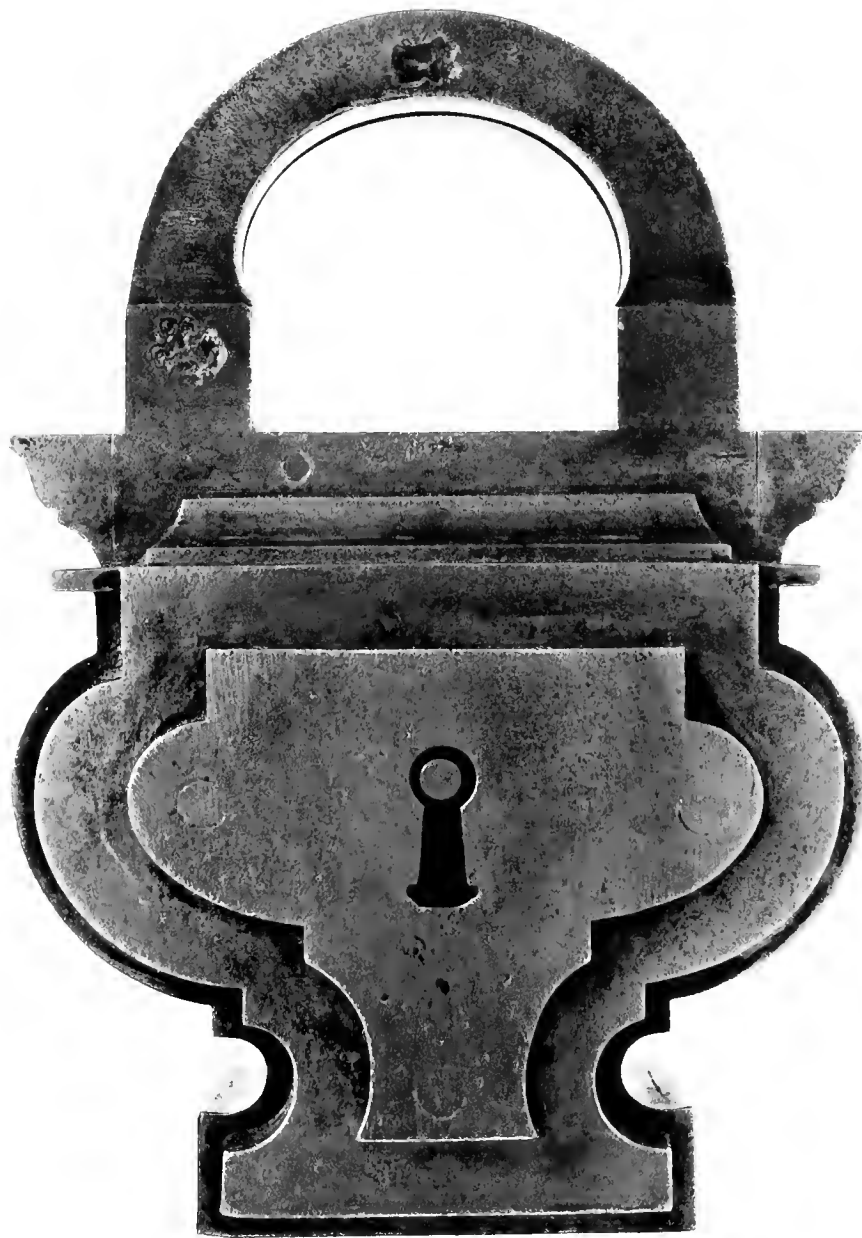
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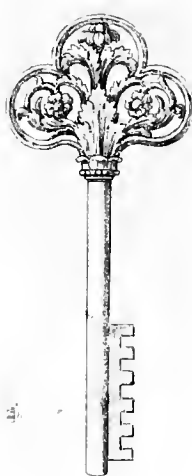


Keys and Locks

in the Collection of the
Cooper-Hewitt Museum



The Smithsonian Institution's
National Museum of Design



Keys and Locks

NK
82
15077
1087
1087

in the Collection of the
Cooper-Hewitt Museum



The Smithsonian Institution's
National Museum of Design

Cover

padlock
German
17th century
steel, 17 cm
1952.161.165a

Inside cover

designs for keys
Italian
19th century
pen and brown ink with
gray and brown washes
1938.88.5514, 5503,
5511, 5497, 5508, 5494, 5492,
5507, 5488, 5505, 5500, 5489,
5509, 5486, 5495, 5502

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Foreword

It is somewhat ironic that with the development of human civilization, the need for protection and privacy has become more critical. For millennia, our strongest and most common defense against thieves and intruders has been a lock and a matching key. Together the two make a powerful combination, although so far not an invincible one, and the struggle to design the “unpickable” or perfect lock continues.

The Cooper-Hewitt's collection of keys and locks was begun shortly after the founding of the Museum in 1897. It offers a wide range of designs that document the history of locks and keys from ancient times to the present. From the most ornately wrought lock meant to grace a finely crafted chest to the latest electronic locking systems, locks and keys in their design and ornamentation mirror the predominant style of the time in which they were made. They also stand as undeniable testimony to the ingenuity of the locksmith and the skill of the craftsman.

Many of the collections within the Cooper-Hewitt represent areas of design that are rarely thought about by any but a handful of designers and scholars. Over the years, the Andrew W. Mellon Foundation has made it possible for the Museum to conduct research on some of these more unusual collections and to present them to the public. Keys and locks comprise one such collection, and once again we wish to thank the Mellon Foundation for its generosity in supporting this special project.

Lisa Taylor
Director



1 chamberlain's key
European
probably 18th century
gilt bronze, 9 cm
1910.30.44

2 chamberlain's key
European
probably 18th century
steel, 13.5 cm
1952.161.26

Security and safety of person and property are needs that are shared around the world, and for thousands of years keys and locks have helped to satisfy these needs. Because locks and other security devices preserve and protect valuables that may range from small jewelry and coins to family homes and warehouses, keys are by nature carefully guarded items, the use of which is generally restricted to responsible individuals. Edgar Frank, an author on the history of French metalwork, succinctly describes the function of the lock and key as a means of distinguishing the difference between “mine” and “thine.”

In keeping with their function of protecting both individual and communal property, keys have become an important symbol of power and status. The temporal power vested in the key is a symbolic reference to

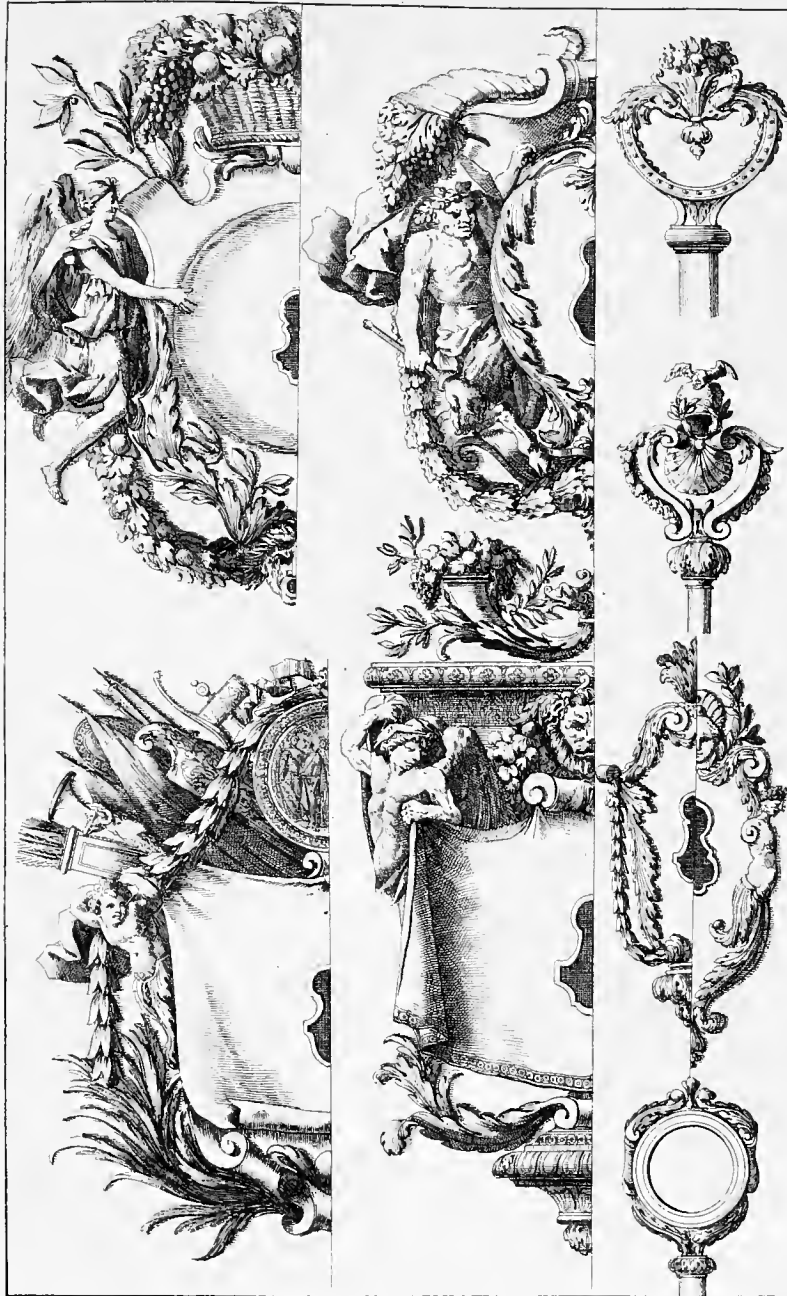
power itself. The goddess Athena carried the keys to her namesake city of Athens as a visual symbol of her importance to the community – a tradition that survives today in the presentation of the “keys to the city” to distinguished individuals. Biblical references to keys and locks also confirm their practical and symbolic use: “And the key to the house of David will I lay upon his shoulder; so he shall open, and none shall shut; and he shall shut, and none shall open” (Isaiah 22:22). The key became the attribute of St. Peter, upon whom the Christian church was founded, and the papal coat of arms is often displayed above a pair of crossed keys. From Shakespeare to Sigmund Freud, the key has remained a powerful visual symbol.



2



3 Albrecht Dürer
(1471-1528)
Germany
*Angel with the Key
to the Bottomless Pit*
1498
woodcut
1950.30.9



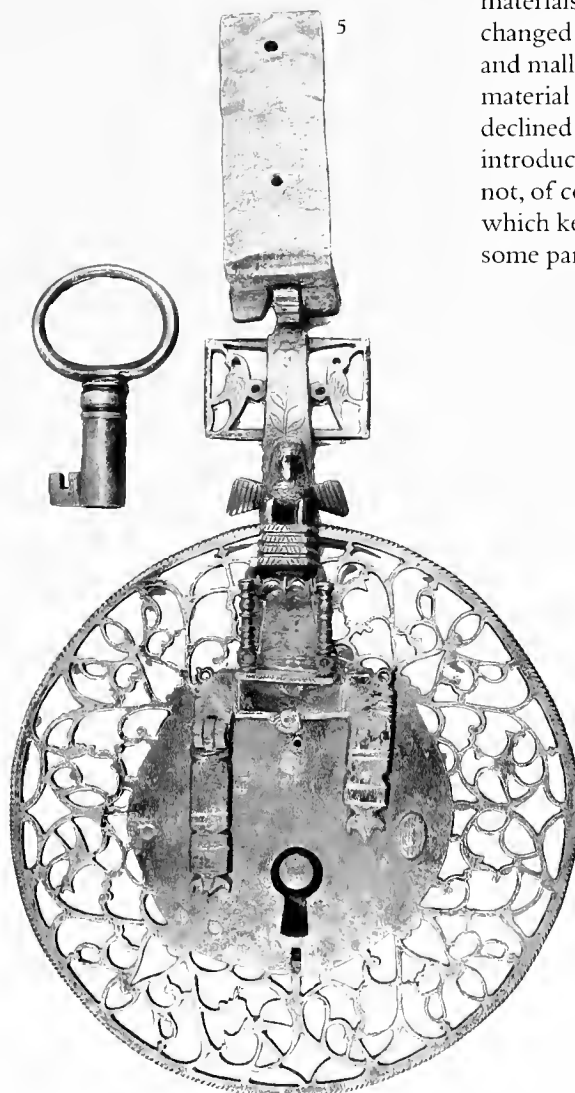
Le Pautre excudit Cum Privilegio Regio.

- 4 Numerous people have speculated on the origins of keys and locks. The earliest security devices may have included a rather simple system of ropes that were tied from the inside of a building or chamber to protect a door or entryway. It is generally believed that keys and locks originated in the Middle East and may have been developed to protect valuable community property such as grain. The earliest locks and keys were carved of wood and were most probably individually crafted by a carpenter who specialized in this work. We know from pictorial and literary records that granary doors were commonly fitted with heavy wooden bolts that could only be thrown by an equally large and heavy wooden key. These early keys utilized single or multiple prongs that fit under a series of movable pins located inside the fixed lock; when these pins were lifted by inserting a key with matching prongs, the bolt on the lock could be thrown and the door opened.

Wood is sturdy, but it is also susceptible to moisture and wear, so nearly all of these early locks and keys have fallen victim to decay and deterioration. Most keys

Jean Le Pautre
 designs for keys
 from *Livre de Serrurerie*
 (Paris: c. 1675)
 engraving and etching
 1921.6.343(8)

chest lock and key
 Spanish
 17th century
 iron, 43.5 cm (lock)
 9.8 cm (key)
 1952.161.136a,b,c



fabricated in the last two thousand years have been made of metal. The Romans often used bronze for their keys, which is durable and has assured the survival of numerous examples from the classical period on. It was the introduction of iron into the locksmiths' repertoire of materials, however, that greatly changed the history of keys; strong and malleable, iron proved an ideal material for locks and keys and declined in popularity only with the introduction of steel. Base metals are not, of course, the only materials of which keys have been made. For some particularly important keys,

6 probably French
18th century
steel, 8.5 cm
1952.161.24

7 German
18th century
steel, 14.2 cm
1952.161.128

8 probably German
17th century
iron, 17.5 cm
1952.161.66

9 probably English
18th-19th century
steel, 10.2 cm

10 French
18th century
steel, 11.2 cm
1952.161.235

11 German or French
17th-18th century
steel, 13.6 cm
1952.161.44



6



7



8

silver and gold have been used, and a few, such as papal keys, were even set with precious or semi-precious stones. In the nineteenth century, mass production of keys brought other metals, such as brass, into prominence, and in our own century, aluminum and special alloys have been most frequently used. Within the last few decades, plastics and electronic devices have come to play roles in the evolution of key design.

Until the nineteenth and twentieth centuries, key design was based on principles that developed in the ancient world. Most keys consist

of three basic elements: the *bow*, the *bit*, and the *shaft*. The bow is the “handle” of the key and is usually elliptical or round to permit easy grasping. The bit is the part of the key that is inserted into the lock and serves as the point of contact between the key and the locking mechanism. Most often, the bit frees the lock when the key is turned through a series of barriers, thus permitting the bolt to be withdrawn. The shaft connects the bow and the bit. There are many



12 lock
probably German
17th century
iron, 27.5 cm
1952. 161. 141b



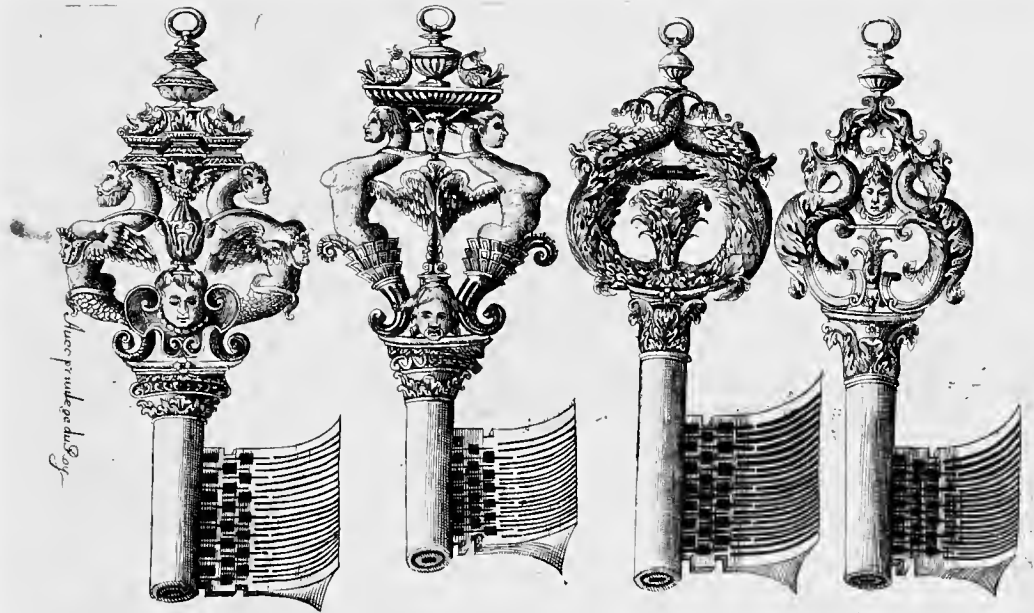
variations on this basic construction, and keymakers have found unlimited ways to vary and ornament each of these elements. Although keys clearly reflect the history of styles and fashions, these three elements have remained identifiable in Roman, medieval, and even in modern keys.

Not surprisingly, since locks and keys were made en suite, changes in the design of keys have followed closely upon changes in lock design. Locks tend to fall into basic categories according to the design of their internal locking mechanisms. The most common of these depends on a system of tumblers that must be pushed away from the lock to permit the bolt to be moved. The simple, multi-pronged wooden lock of the ancient world serves as an archetype of the principle still in use in certain locks. Later sophistications in lock

- 13 Mathurin Jousse
designs for escutcheons
and keys
from *La Fidèle Ouverture*
de l'art de Serrurier
(Paris: 1627)
engraving and etching
1921.6.324(3)

design included the introduction of complicated “wards,” or metal teeth, and other barriers that permitted only a key with matching cuts in the bit to penetrate and turn the lock. In the nineteenth century, designers attempting to provide perfect security filed a plethora of patent applications for new key designs that greatly expanded the technology of lockmaking. In our own century, most ordinary keys and locks have returned to an ancient locking

principle that utilizes tumblers (analogous to the movable pin) that are raised as the key enters the lock. Commonly used locks today range from small padlocks for luggage and briefcases to combination locks and virtually unpickable electronic devices that respond to a plastic “credit card” substituted for the traditional key.



14 probably German
17th-18th century
steel, 13.5 cm
1952.161.115

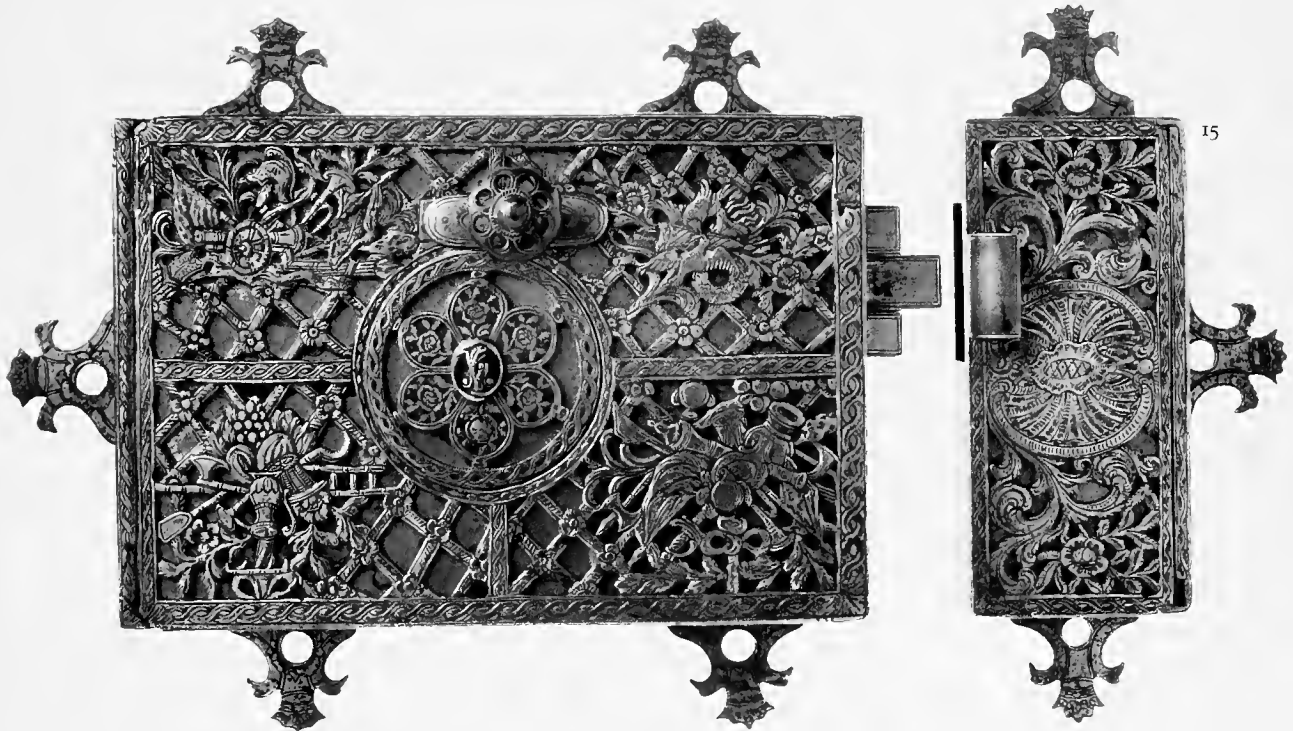
15 Spanish
17th century
signed *Jean Dutartre*
steel, 22.5 cm
1910.30.49



The history of locks and keys is inseparable from the history of the art and craft of the blacksmith and locksmith. By the medieval period, craftsmen frequently organized themselves into brotherhoods or guilds according to their trades. This served to protect their economic interests, as well as to maintain the standards of design and execution that the craft depended upon for its financial survival. The guilds created a system of instruction for apprentices through which aspiring artisans received training in the workshops of qualified masters. By the late fourteenth century, France's system of apprenticeship in the field of ironworking had been codified and required an apprentice to complete and submit for approval a "masterpiece" in documentation of his workmanship before he could be accredited as a qualified master. The supervision and training provided by such guild systems insured that the standards of the craft could be maintained; at the same time, it introduced a certain conservatism in the craft that is reflected in the gradual change in lock and key ornamentation.

Until the adoption of cold-worked hammered and chiseled metal in the seventeenth century, most locks and keys were laboriously hammered out on the anvil while the metal was red-hot. The art of the blacksmith began to lose its importance with the introduction of cold-metal techniques in which solid pieces of metal were sculpted with chisel and file to create highly sophisticated designs. Blacksmiths served as an important source of keys for most people until keys began to be mass-produced in the nineteenth century.

Innovative design was a hallmark of Roman keymakers and locksmiths. Archeological excavations at Roman sites throughout Europe have unearthed an astonishing variety of designs, including ring keys and folding keys that probably unlocked small caskets containing personal



15

valuables. The Roman keys in the Cooper-Hewitt's collection are typically small enough to have been carried on the person. A notable variety of types were common in Roman key designs. Some bits include refinements such as small teeth that were specifically designed to match the cuttings on a lock; some were made without teeth and opened the lock with a simple turn. Other variations include bits with additional cut-out sections in combination with elongated teeth, both of which were designed to match the configuration of holes cut into the locking mechanism. Some keys from Roman settlements closely resemble those made by the Celts, whom the Romans conquered; many of these are anchor-shaped, with an elongated shaft that offers a convenient area for ornamentation. The bows of others were created in the form of an open circle to permit the key to be hung on a strap or chain or to be worn on the finger, with shaft and bit held in the palm of the hand.

Many Roman keys were made of bronze, and these have acquired a rich green patina over time. Those made of iron, however, have rusted and decayed, just as the locks used by the Romans have virtually disappeared.



16 Roman
bronze, 11.5 cm
1909.2.270

17 Roman
bronze, 5.5 cm
1909.2.274

18 Roman
bronze, 8.5 cm
1909.2.278

19 Celtic
iron, 9 cm
1910.1.8

20 Celtic
iron, 16 cm
1910.1.7

21 Celtic
bronze, 6.2 cm
1901.1.9



17



18



19



20



21

22 Medieval European
14th-15th century
iron, 13.3 cm
1910. 10.5

23 Medieval European
14th-15th century
iron, 31cm
1976. 1. 116

24 Medieval European
14th-15th century
bronze, 6.7 cm
1910. 10.6



22



23



24

The technology of lock and key design did not change dramatically from the Roman period until the Middle Ages, when significant innovations began to make their mark. Most keys of the medieval period are made of iron, although the use of bronze did not disappear entirely. One of the most easily recognized characteristics of so-called Gothic keys is the emphasis given to the design of the bit. Not only did the bits of medieval keys tend to be large, but they were often cut in ornamental patterns,

such as Latin crosses. The bits of some medieval keys have teeth, but these were most often used to turn the lock rather than to lift prongs inside the lock, as was the case in older locks.

The bows of medieval keys were the focus of much of their ornamentation; shapes such as circles, diamonds, or lozenges often appear on keys of this period. The shafts of most medieval keys are round, and made of solid metal. Although a large number of them are as small as their Roman predecessors (between five and twelve centimeters), there are many examples of outsized keys that range between fifteen and twenty-five centimeters in length. These imposing instruments were visible symbols of power and prestige for their owners or users and certainly safer from inadvertent loss than their smaller cousins.



25

- 26 chest lock
possibly German
possibly 16th century
iron, 32 cm
1952.161.140a,b

- 27 French
16th-17th century
iron, 17.5 cm
1909.27.4

- 28 "Venetian"
16th-17th century
iron, 11.5 cm
1909.2.243

- 29 probably French
16th-17th century
steel, 8.9 cm
1952.161.13



Another distinguishing feature of keys from the Middle Ages is their long "nose," which is the section of the shaft that extends beyond the bit. During subsequent periods, this nose was used to open the hidden covers of the keyhole. These simple and sturdy keys sometimes accompanied elaborately ornamented locks. The influence of the church is also noticeable in the designs of many locks, both ecclesiastical and domestic; one in the Museum collection, a later example in the medieval style, is made with a cover plate that depicts a series of saints or religious figures arranged within a complex architectural setting.

26

Ornamental lock designs continued to be produced well after the late Gothic period. The Cooper-Hewitt collection contains an axe-shaped lock, the relatively simple mechanism of which is disguised by a lively ornamentation of flowers and tendrils. The heads of the metal pins that hold the lock together are made as blossoms, and paired spiral tendrils impart an energetic movement to the surface design.

Another late medieval stylistic development came with the enrichment of the bow to include delicate tracery that echoed the pattern of rose windows in Gothic cathedrals. This “rosette” or “Venetian” style bow was most frequently fabricated from small sections of metal soldered in place to create snowflake-like patterns. The number and complexity of these patterns varied greatly, but nearly all were symmetrical. Many of the bows included a supplementary ring at the top, presumably to facilitate tying the key on a string or attaching it to a chain.



27



28



29

One of the later medieval keys in the Museum's collection is notable for a special refinement in the rosette motif. This key retains the typical rounded rosette bow, but with two rosette panels enclosing a space. In addition, there is a relatively large "crown" on the top of the bow. These design details, often referred to as "cockscombs," are common among fifteenth- and sixteenth-century French keys. In later decades, the ornamental



30 German
17th century
iron, 8.8 cm
1909. 2. 252



31 German
16th century
iron, 16.7 cm
1952. 161. 162



32 French
late 18th century
bronze and
gilt bronze, 6 cm
1910. 1. 3



33 French or English
18th century
steel and brass, 7.7 cm
1909. 2. 260

34 French
17th century
steel, 11.5 cm
1952.161.7

35 French
17th century
steel, 11.7 cm
1952.161.114

36 French
18th century
steel, 11.2 cm
1952.161.2

cockscomb grew in size and importance in the design, reaching its zenith in the seventeenth century when it was featured as a prominent element of “masterpiece” keys created by apprentices to prove their qualifications to become master locksmiths.

During the Renaissance, key designs were introduced that incorporated new ornamentation, including elegant and refined scrollwork fabricated of iron and soldered with copper. The shafts of many of these keys are hollow, made of a sheet of

metal rolled into a tube. The shape of the bit is often a clue to the purpose of keys in this period; for example, bits with lower edges cut into complex patterns were frequently used for padlocks. In contrast, keys with solid-edged bits were most likely used for chests and other lockable furniture.



37 probably French
18th century
steel, 13.5 cm
1952.161.23

38 French
17th century
steel, 14.3 cm
1917.10.2

39 probably French
18th century
steel, 12.7 cm
1952.161.3

40 possibly French
17th-18th century
iron or steel, 11.4 cm
1909.2.240

Differences in key design from one country to the next become increasingly apparent from the sixteenth and seventeenth century onward. Bits cut in complicated, symmetrical patterns were typical of German key design, as were rounded or kidney-shaped bows, and those in the form of trefoils.

French keys sometimes incorporated the fleur-de-lis in their design, and French artisans also often included refined openwork passages that suggest the delicacy of lace. Although the keys from this period in the Museum's collection show the bow designs to be relatively simple, sixteenth- and seventeenth-century engravers offered a wide and sometimes bewildering variety

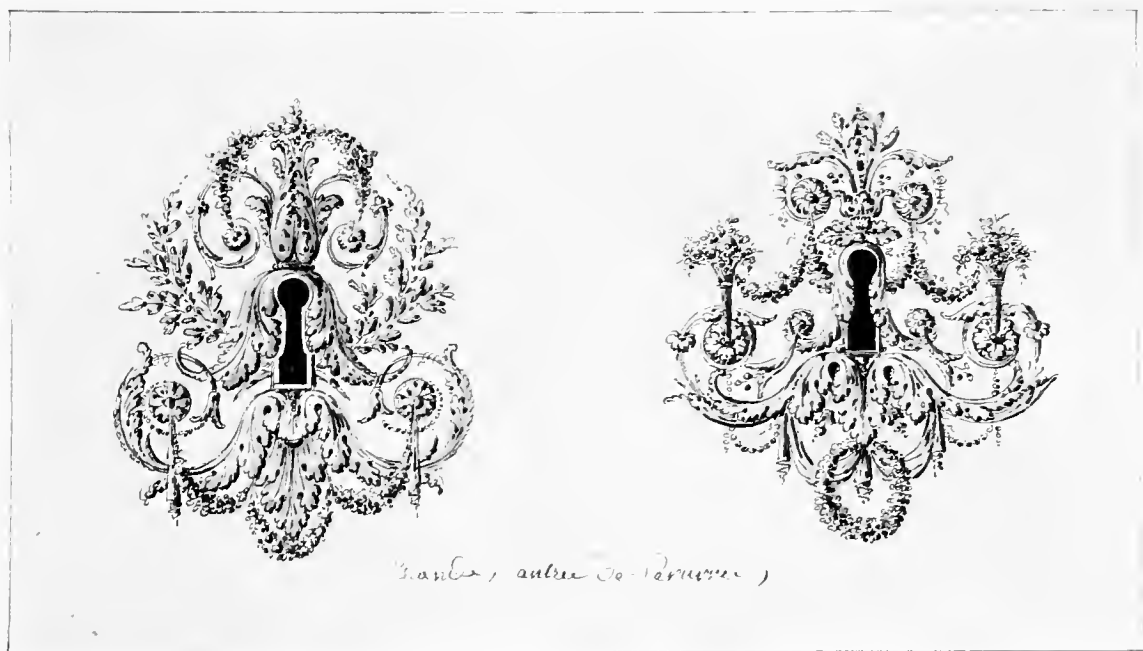


41 Richard de Lalonde
(active 1780-96)
France
*Two Designs for
Gilt Bronze Key Plates*
c. 1780
study for plate 5
*XXVme Cahier
d'Oeuvres Diverses*
(Paris: c. 1780)
pen and black ink
black and gray wash
1911.28.187

of ornamental patterns that circulated throughout Europe by way of printed design books. Many of these patterns for keys are documented in the Museum collection.

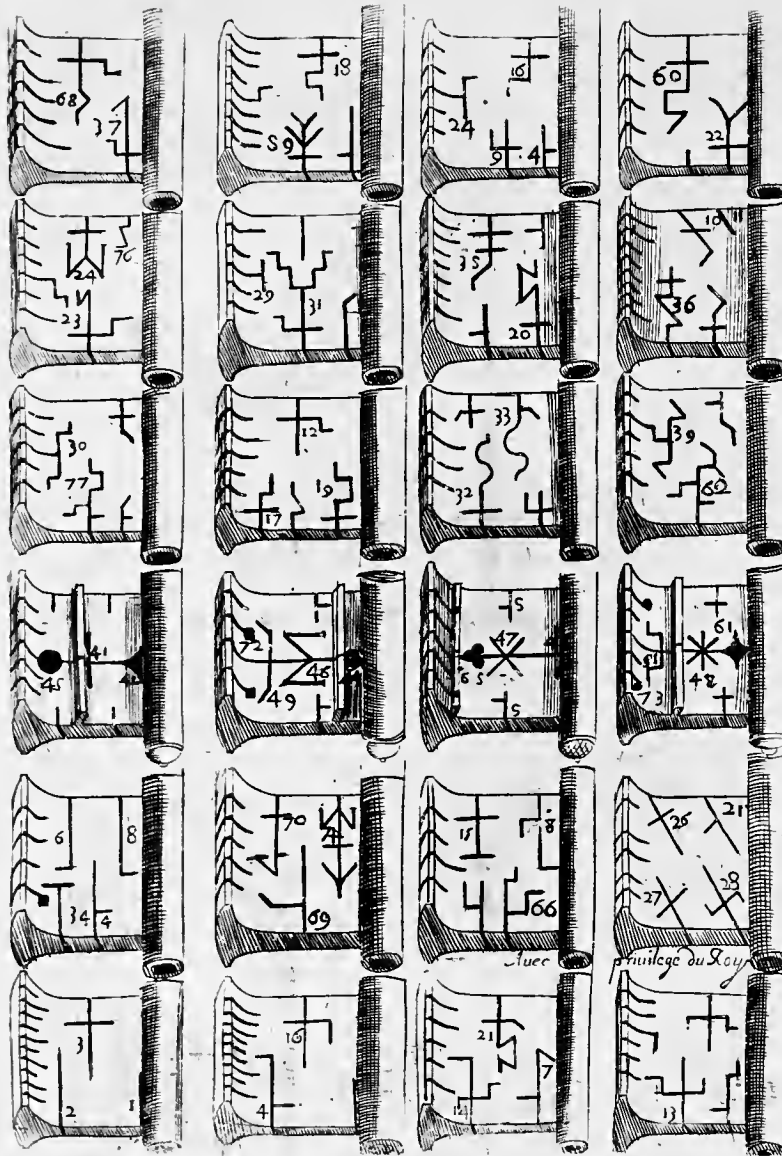
The seventeenth century also saw a great increase in figural ornamentation on keys, with special emphasis given to animal motifs. The Museum's collection includes a number of keys with bows in the form of addorsed dolphins or mythological creatures. While some of these animals may be armorial in purpose, a number of designs

were purely ornamental. Personal ownership of keys by the aristocracy was often indicated through the incorporation of initials into the design of the bow of the key or by using family coats of arms as the central decoration. During the seventeenth century, most heraldic devices were carved in the bow rather than cast in relief, although variations are well documented.



42 The majority of the Cooper-Hewitt's keys from the seventeenth century are assumed to be personal keys, although a number clearly had official uses. One German key, for example, is ornamented with a cross within its bow and was most likely used in a church or chapel. Bits on such keys may be highly complex or quite simple. Some of the simpler cuts take on the form of stars, and some keys use a repeated star pattern. Another variation in the form of the bit is the "screw" bit, which resembles a corkscrew. This type of key, generally reserved for use with padlocks, remained in vogue for several centuries.

Some keys from the seventeenth century display innovative designs, such as a double key with a sliding hollow bow that can be moved from one end of the key to another to create a handle for opening the lock. The delicacy of key-making is revealed in the finely cut bits characteristic of French workmanship of the period. On some keys the cuts in the bit do not interrupt the edge of the key itself. The finely cut



- 42 Mathurin Jousse
patterns for wards
from *La Fidele Ouverture
de l'art de Serrurier*
(Paris: 1627)
engraving and etching
1921.6.324(31)

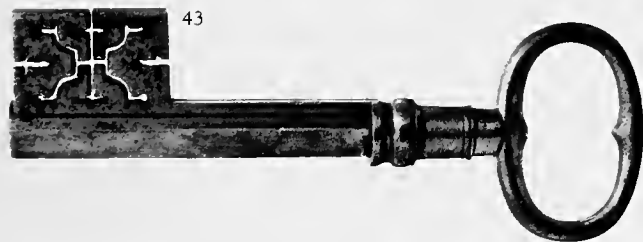
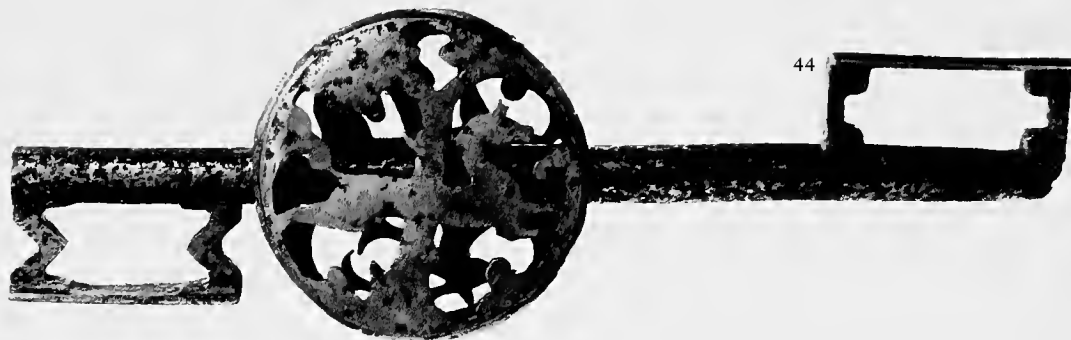
- 43 German
17th–18th century
iron, 18.5 cm
1904.14.2

- 44 French
17th century
steel, 14 cm
1909.2.238

patterns inside the bit proper indicate the complexity of the locks for which these keys were designed.

The eighteenth century witnessed a dramatic increase in the number of keys; far more people used them on a daily basis than in earlier periods. The stylistic development of keys and locks was also stimulated and reached the zenith of aesthetic and ornamental sophistication. The Museum's collection includes

elaborately decorated eighteenth-century keys used for a number of functions ranging from securing dwellings to locking valuables in furniture and chests. A wide variety of containers and boxes were also fitted with small locks to protect valuable comestibles such as tea and sugar.



45 German
18th century
iron, 14.3 cm
1952.161.81

46 German
18th century
steel, 8.4 cm
1952.161.35

47 English
18th century
steel, 12.7 cm
1952.161.18

48 English
18th century
steel, 7 cm
1952.161.20

49 English
18th century
steel, 8 cm
1952.161.8

50 English
19th century
brass, 15.3 cm
1923.13.5

51 English
late 19th century
brass, 13 cm
1923.13.6



German locksmiths made some highly elaborate keys and locks in the eighteenth century, many of them having bows with scrollwork and foliage decoration, and star-cut bits. Ordinary English keys tended to be plain and serviceable, entirely functional ancestors of the so-called “skeleton” key with which we are all familiar. They stand in contrast to a smaller group of highly ornamental English keys that, like their French counterparts, incorporated complex scrollwork designs into their bows. Although the major focus of decoration remained the bow, some fine English keys of this period also show elaborate ornamentation of the shaft and bit.

Increasingly, coats of arms and initials were incorporated into the design of bows during the eighteenth century to indicate the identity of the owner. Also during this period, the number of symbolic or ceremonial keys increased, resulting in the production of a wide range of impressive “chamberlain’s” keys. From the sixteenth to the eighteenth century, the keys retained by the chamberlain at court or in an aristocratic residence had been primarily functional – it was these keys that assured the security of the family and their possessions. From the eighteenth century onward, highly ornamental keys have been carried as a perquisite and symbol of office rather than for actual use.



48



49



47



50



51

Such keys, beautifully crafted and often gilded, were generally worn on special occasions. The Museum's collection contains several examples of such ceremonial keys, most with armorial devices, coats of arms, initials, or monograms. Some of the Museum's keys bear insignia or arms that associate them with European royalty. Since many of them show no sign of actual use or wear, their symbolic purpose is undeniable.

Other innovations that arose during the eighteenth century included cleverly designed folding or collapsing keys. Such keys were convenient for carrying in a pocket, and many can be seen as predecessors of nineteenth-century "patent" keys.

In spite of the refinements that occurred in lock and key design from the sixteenth century onward, most locks were highly susceptible to easy picking until the eighteenth century. During the course of that century, lockmakers attempted to provide heightened security with devices that would be certain to foil burglars and other crooks. Locks were considered essential for houses, and the growing use of lockable



- 52 chamberlain's key
Austrian, Emperor
Ferdinand I
19th century
gilt bronze, 18.2 cm
1909.27.7

- 53 chamberlain's key
probably German
19th century
gilt bronze, 16.2 cm
1909.27.6

- 54 chamberlain's key
Initials of the
Archbishop of Cologne
late 19th century
gilt bronze, 14.5 cm
1909.27.8

- 55 chamberlain's key
probably German
18th-19th century
gilt bronze, 10.7 cm
1967.48.41

furniture, the institution of banks, and a rise in the crime rate all contributed to the rapid growth of mass-produced keys. The increasing importance of functional locks and keys mirrored changes in population movements. As industrialization

occurred, families abandoned rural life for the cities, and as urban centers mushroomed, so too did poverty and crime. A certain amount of protection for person and property could be provided by locks and keys – a development that, combined with an increasing reliance on public police protection and banks, serves as a commentary on the nature of progress during the eighteenth century.



56 folding key
European
18th century
iron, 20.8 cm



These developments not only stimulated the craft of lockmaking; they also engendered a climate of competition among inventors and designers to produce less easily picked locks. An all too familiar cycle was established whereby every time a better lock was made, thieves rose to the challenge and figured out how to pick it. Robert Barron invented a twin-tumbler lock in 1778, considered by many to be the first major technological advance in lock-making. However, it was Joseph Bramah (1749–1814) who won international fame with his 1784 patent for the “Bramah Cylindrical Lock.” In 1811 he went on to found the first lock and key manufactory to utilize mechanical duplication of standardized separate parts.

From that date, the history of lock and key manufacturing changed radically as more and more competitors entered the field with inventions to foil thieves and lockpickers.

In England, where many of the nineteenth-century advances in lock and key design were developed, the Chubb brothers, Charles and Jeremiah, achieved wealth and success with their 1818 patented “Detector” lock. The fame of the Chubbs in their specialized field was heightened by their participation in the 1851 Crystal Palace Exhibition; at this landmark international trade fair, the Chubbs were commissioned to make the locked gold case in which Queen Victoria’s famous “Koh-i-noor” diamond was exhibited. Embarrassingly, it was at this same exhibition that an enterprising American locksmith and inventor named Alfred C. Hobbs publicly picked both a Bramah and a well-known Chubb lock, the latter of which was said to be unpickable. Hobbs earned a large cash prize for his efforts.

Hobbs’s success was eventually overshadowed by the Yale family of Middletown, Connecticut. Linus Yale, Sr. (born in 1797), established himself as a lockmaker around 1840. His son Linus (1821–1868) turned the family business into one of the most successful nineteenth-century firms specializing in bank locks.

57 Oriental
19th century
iron, 17.5 cm
1952. 161. 180c

58 Oriental
19th century
iron, 17.5 cm
1952. 161. 173c



Seeking both improved security and a reduction in the size of locks and keys, the Yales revolutionized the history of mass-produced keys and locks.

These innovations in design, the industrialization of the craft, and the large demand for locks and keys necessarily led to a decline in their individual design characteristics. Today it is difficult to distinguish keys made in different countries or by different firms on the basis of design. Stylistic issues continued to play a part even in industrially manufactured keys in the 1920s and '30s, however. Some keys, for example, were designed with bows that echo the stepped profile of skyscrapers. Nonetheless, fewer craftsman-designed and -fabricated keys have been made in the twentieth century. From the unique and carefully handcrafted creations that had been produced for over two thousand years, keys and locks have become internationally standardized and plainly designed tools.

Despite the decline of stylistic innovation, the history of locks and keys in the past few decades has been even more dramatically altered by the introduction of new technologies and materials. Many security devices are electronically controlled and monitored and do not require a metal key at all. Hotel guests

are now often provided with an electronically-coded card or plastic key to their rooms, rather than with a cumbersome tagged key intended to remind them to return it when they leave; the locking code programmed into such computerized keys requires only a reprogramming to provide a new security code and, essentially, a new key. Security systems have also been developed that need no passkey whatever – voice pattern recognition, fingerprint security systems, and push-button codes are now counted among the descendants of the traditional locks and keys used by the Egyptians, Romans, and our more immediate ancestors.

Although their form and appearance may change radically, locks and keys will remain an indispensable part of our daily lives as long as human beings require security for themselves and their possessions. The history of their craftsmanship and design, in partnership with technology and innovation, is clearly recorded for posterity in the key and lock collections of the Cooper-Hewitt Museum.

Dr. Bert Spilker

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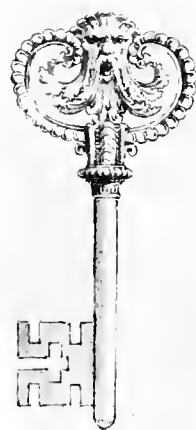
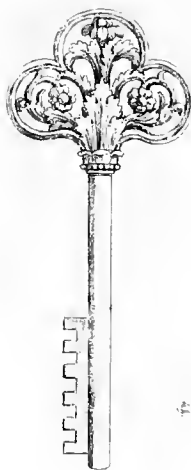
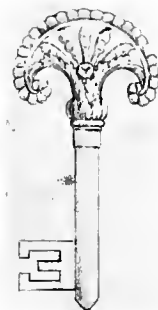
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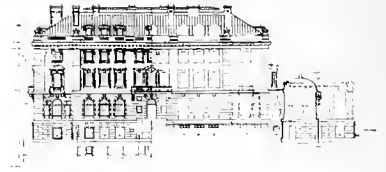
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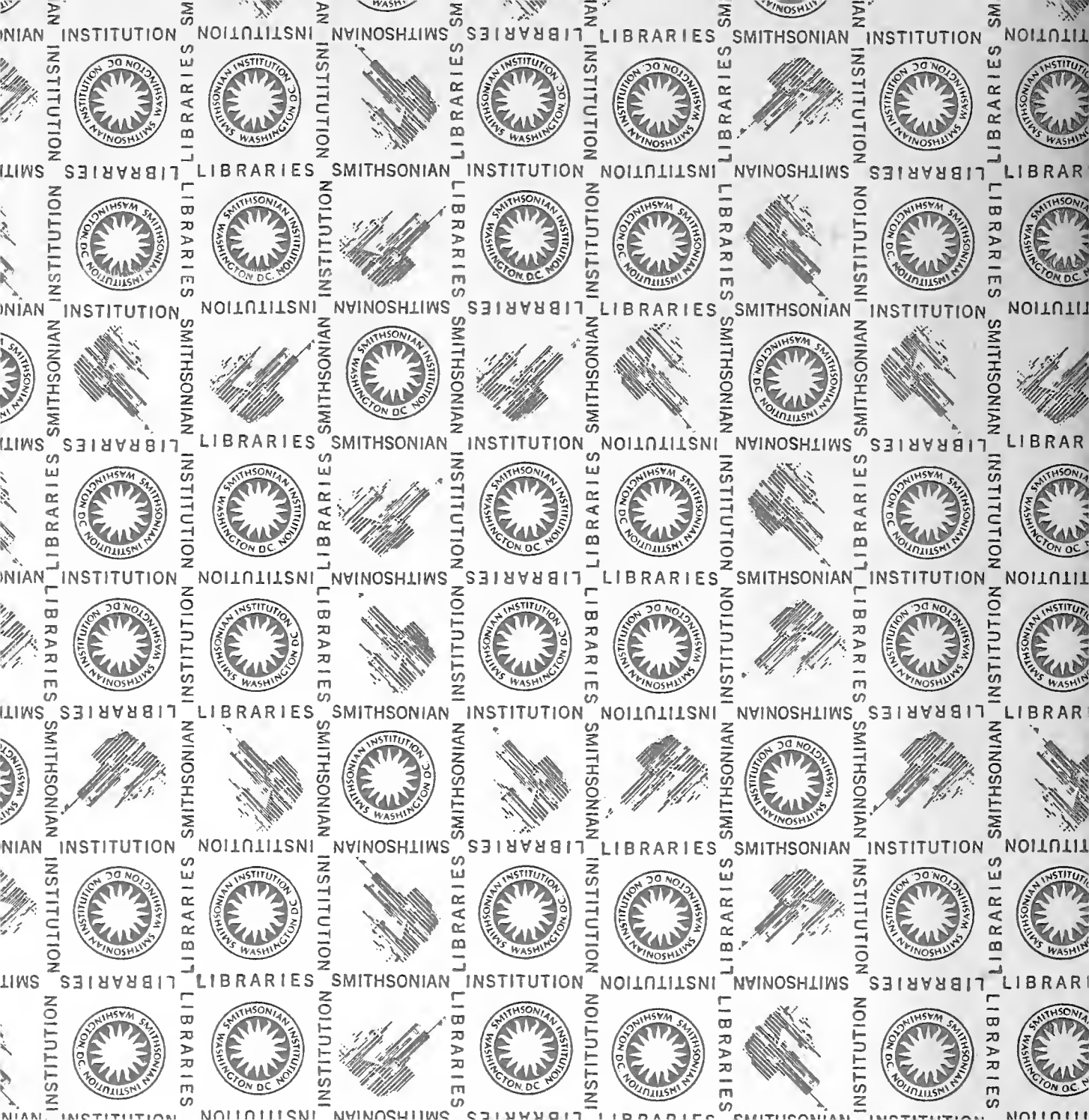
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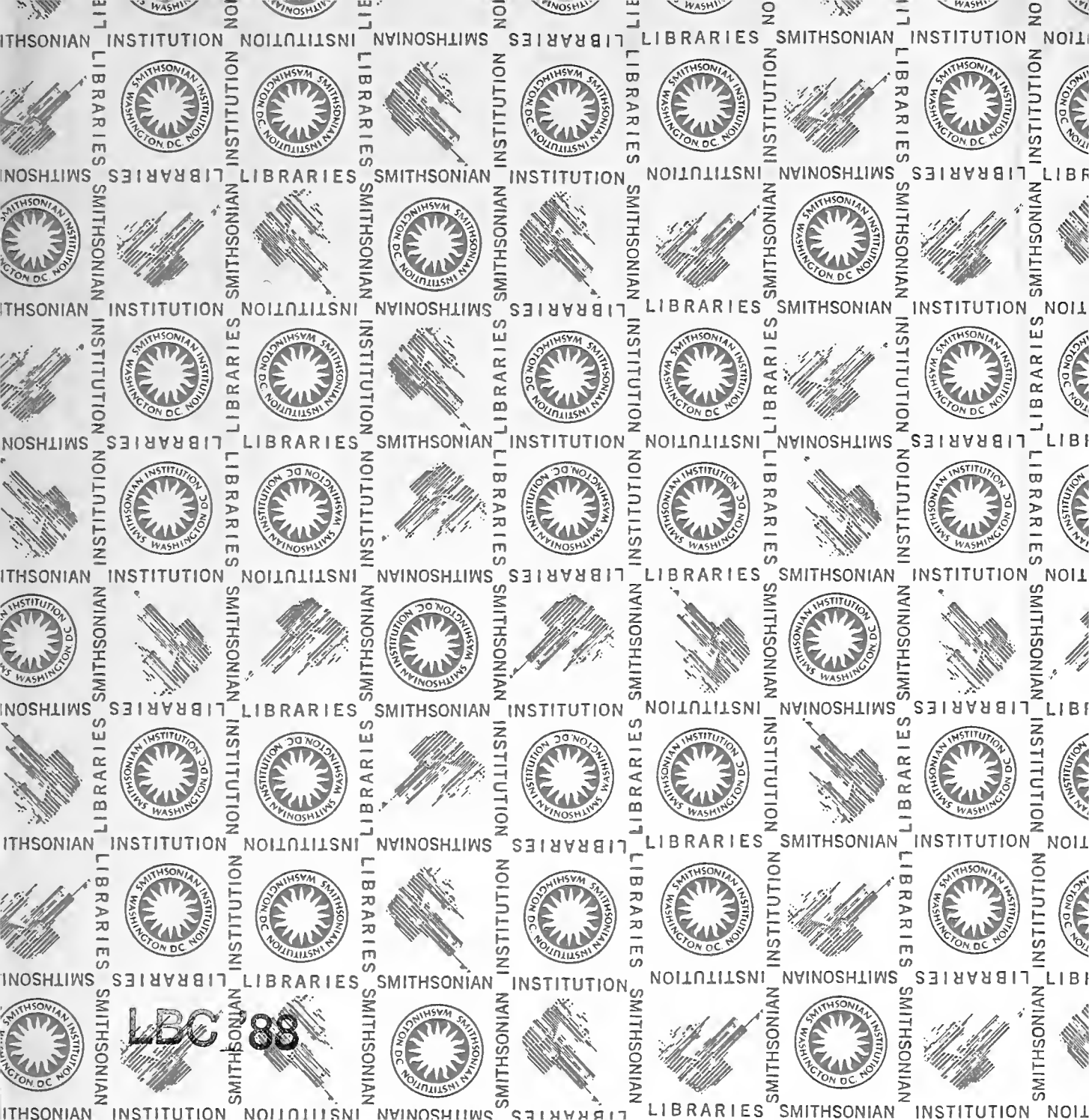




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